COMP90042

Web search and text analysis

Workshop Week 3

Your tutor

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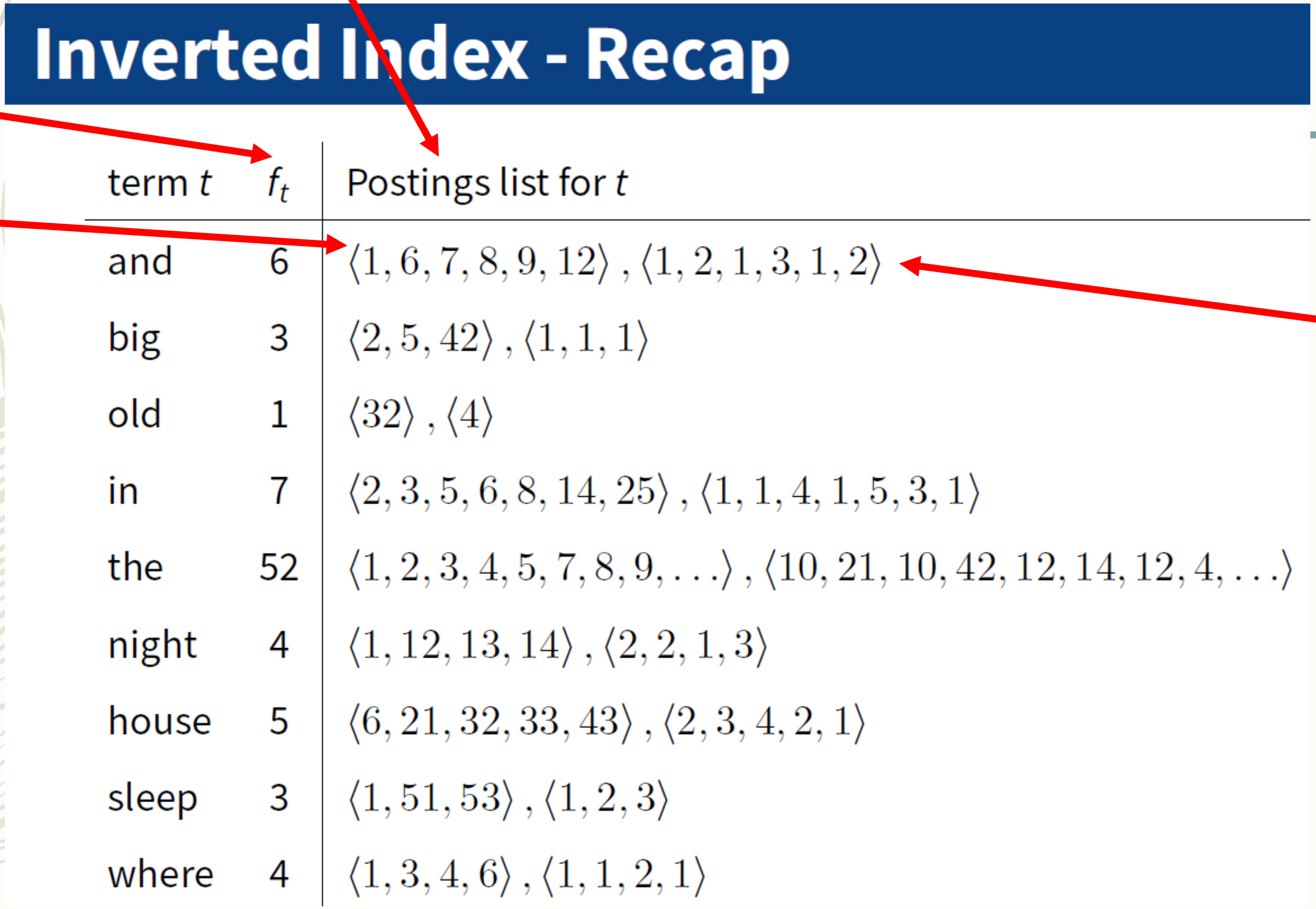
- Here, you can find my workshop slides:
- https://github.com/winnchow/COMP90042-Workshops

Postings list



Inverted Index - Recap

term t	f_t	Postings list for t
and	6	$\langle 1, 6, 7, 8, 9, 12 \rangle , \langle 1, 2, 1, 3, 1, 2 \rangle$
big	3	$\langle 2, 5, 42 \rangle , \langle 1, 1, 1 \rangle$
old	1	$\langle 32 \rangle , \langle 4 \rangle$
in	7	$\langle 2, 3, 5, 6, 8, 14, 25 \rangle , \langle 1, 1, 4, 1, 5, 3, 1 \rangle$
the	52	$\langle 1, 2, 3, 4, 5, 7, 8, 9, \ldots \rangle , \langle 10, 21, 10, 42, 12, 14, 12, 4, \ldots \rangle$
night	4	$\langle 1, 12, 13, 14 \rangle , \langle 2, 2, 1, 3 \rangle$
house	5	$\langle 6, 21, 32, 33, 43 \rangle , \langle 2, 3, 4, 2, 1 \rangle$
sleep	3	$\langle 1, 51, 53 \rangle , \langle 1, 2, 3 \rangle$
where	4	$\langle 1, 3, 4, 6 \rangle , \langle 1, 1, 2, 1 \rangle$

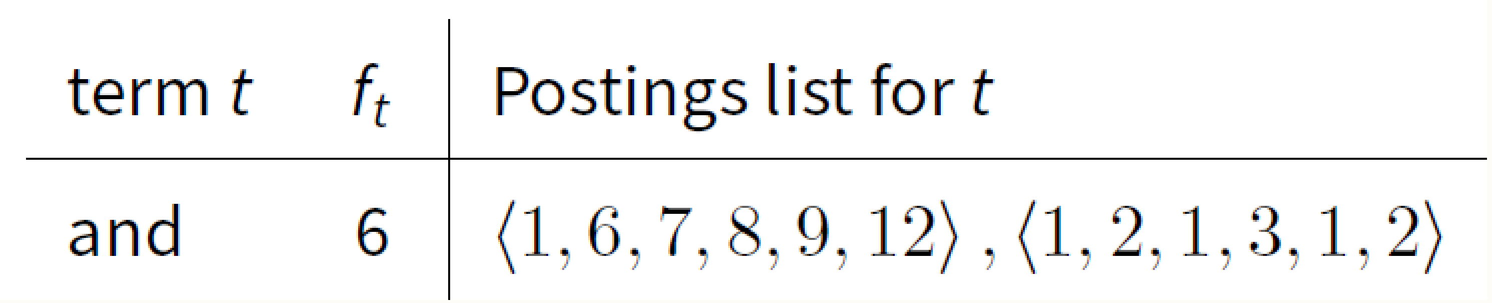
Document frequency

Document IDs

Term frequency

Compression

– How should we compress the document IDs?



term t	f_t	Postings list for t
and	6	$\langle 1, 6, 7, 8, 9, 12 \rangle$, $\langle 1, 2, 1, 3, 1, 2 \rangle$

– Document IDs: <1, 6, 7, 8, 9, 12>

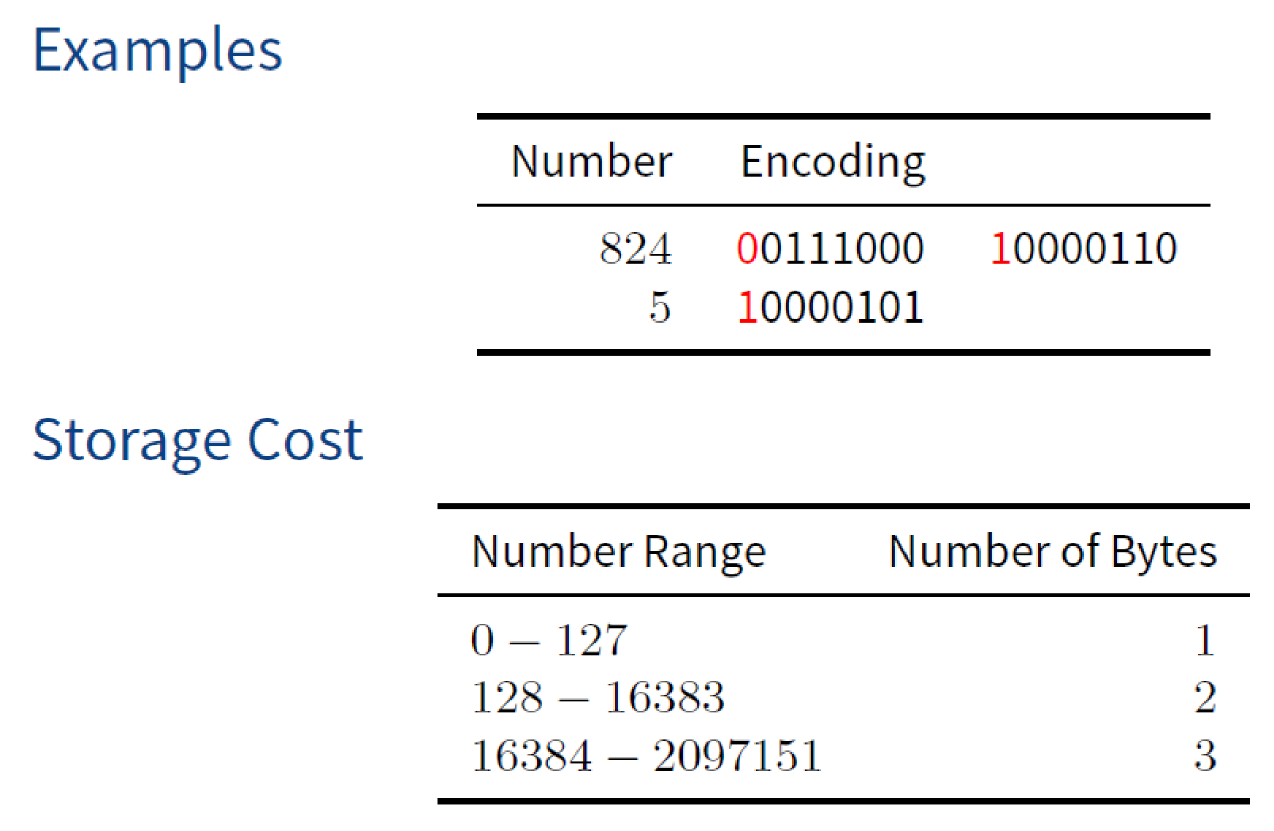
– **Gaps**: <1, 5, 1, 1, 3>, so *mostly small numbers*

– Variable Byte (Vbyte) Compression

Mostly small numbers

- For example, 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,2,3
- We may encode 1,2,3 using 2 bits each.
- How about we use 0 => 1, 10 => 2, 11 => 3?

Variable Byte Compression



Examples

Number	Encoding	
824	00111000	10000110
5	10000101	

Storage Cost

Number Range	Number of Bytes
0 – 127	1
128 – 16383	2
16384 – 2097151	3

824 = 110 0111000

Q1 (c)

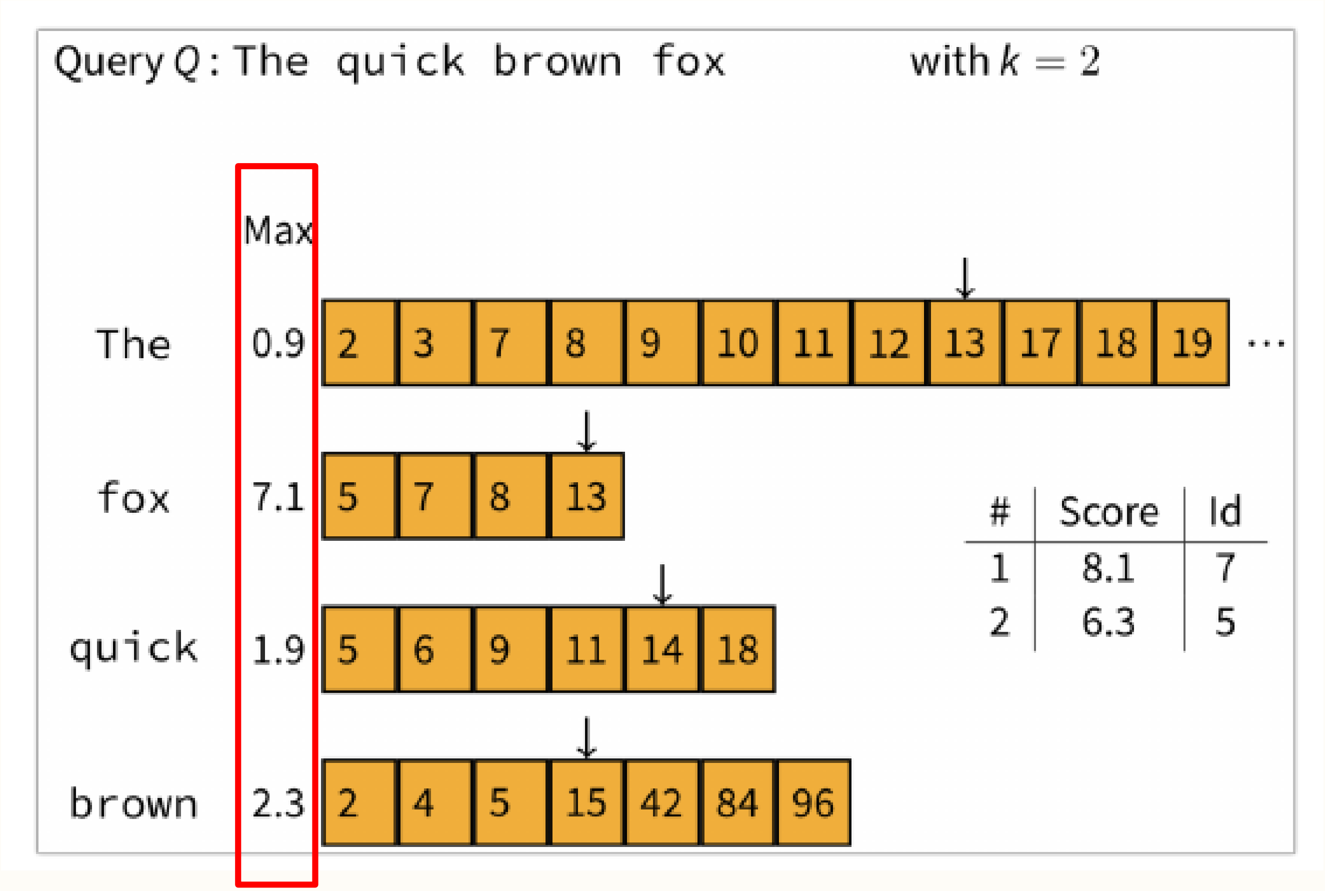
- Determine the values of integers X and Y that were encoded as the byte sequence [52,34,147,42,197] using the Variable Byte algorithm described in the lecture slides 9/10.

Q1 (c)

- 52 = 00110100
- 34 = 00100010
- 147 = 10010011
- => 0010011 0100010 0110100 = 315700
- 42 = 00101010
- 167 = 11000101
- => 1000101 0101010 = 8874

WAND – top-K query processing algorithm

$$S_{\text{TF-IDF}}(d, Q) = \sum_{t \in Q} tf_{d,t} \times \log \frac{N}{df_t}$$



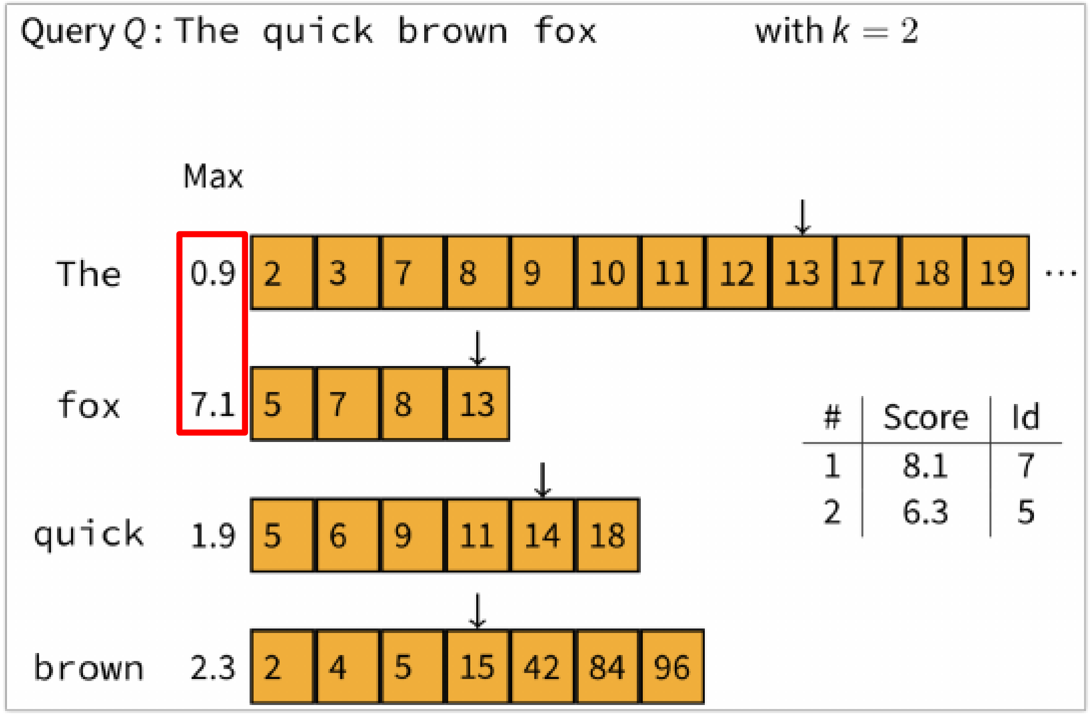
Query Q: The quick brown fox with $k = 2$

	Max													
The	0.9	2	3	7	8	9	10	11	12	13	17	18	19	···
fox	7.1	5	7	8	13									
quick	1.9	5	6	9	11	14	18							
brown	2.3	2	4	5	15	42	84	96						

#	Score	Id
1	8.1	7
2	6.3	5

Q2

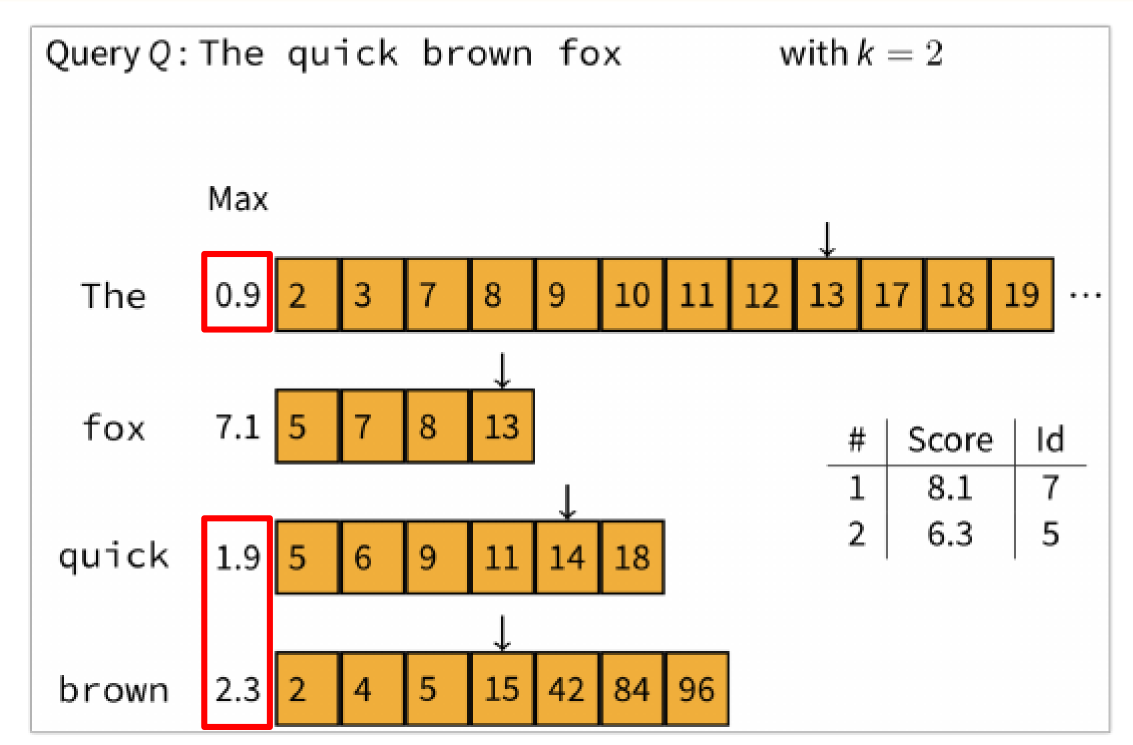
- Doc 13 is evaluated
- Max score for Doc 13 is 0.9 + 7.1 = 8.0
- So Doc 13 might enter the top-2 list


Query Q: The quick brown fox with $k = 2$
Max
The 0.9 2 3 7 8 9 10 11 12 13 17 18 19 ...
fox 7.1 5 7 8 13
quick 1.9 5 6 9 11 14 18
brown 2.3 2 4 5 15 42 84 96

#	Score	Id
1	8.1	7
2	6.3	5

Q2

- No more documents will have “fox”
- Max score possible for a document with “The”, “quick” and “brown” will be 0.9 + 1.9 + 2.3 = 5.1
- Lower than the scores of the top-2 documents
- So, we stop.



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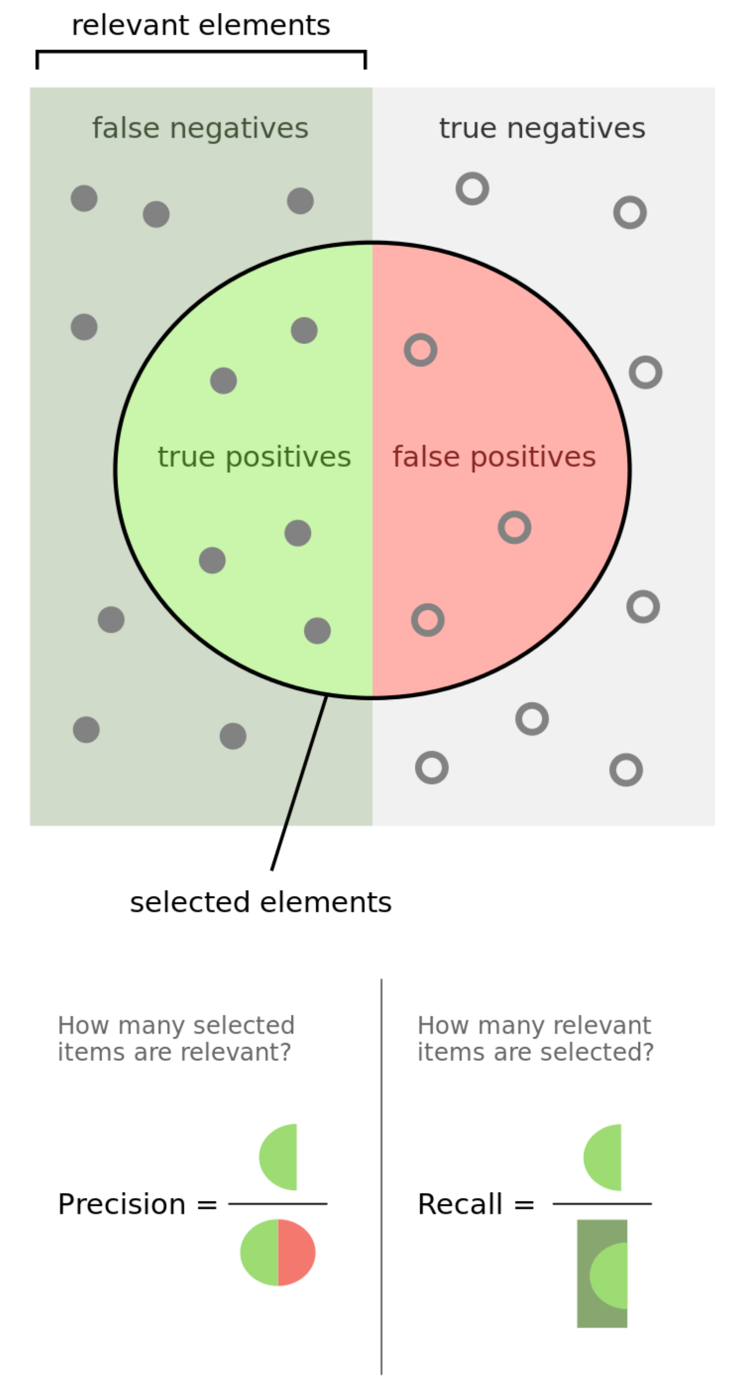
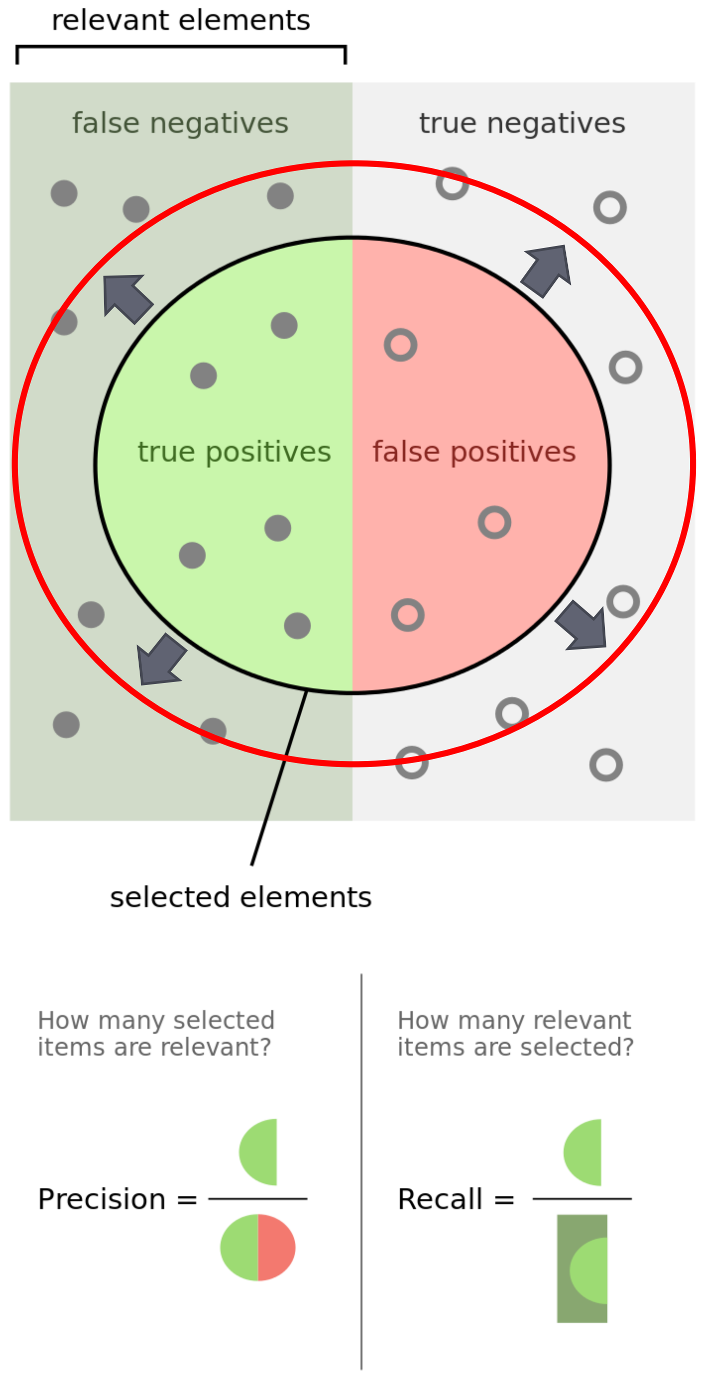
Recall and Precision

- https://en.wikipedia.org/wiki/Precision_and_recall



Query Expansion



Q4

- (a) User relevance feedback
  - e.g. ask users to click
- (b) Pseudo relevance feedback
  - e.g. blind feedback, search the top-K documents and perform topic modeling
- (c) Indirect relevance feedback
  - e.g. analyze query click logs to re-rank documents

Very Useful Online Resources

- Andrei Broder - WAND Revisited
    - https://youtu.be/gwsWUPVtt6Q?t=433